55 $\frac{dy}{dx} = e^{\frac{x-y}{2}}$ $\frac{dy}{dx} = -e^{\frac{y-x}{2}}$

$\left(e^{\frac{x-y}{2}}\right)\left(-e^{\frac{y-x}{2}}\right) = -1$

$\left(e^{\frac{x-y}{2}}\right)\left(-e^{\frac{-1(x-y)}{2}}\right) = -e^{0}$

Dec 3-9:23 AM

6.2a Integration by Substitution memorize p332 (easy)

A change of variables can turn an unfamiliar integral into one that we can evaluate. (The differential matters.) (dx ≠ du)

hard easy

$\int f(x)\,dx = \int g(u)\,du$

composite

$\boxed{\text{let } u = \text{inside of composite}}$

$\int \sin(x)e^{\cos(x)}\,dx = -\int e^{u}\,du = -e^{u} + c$

let $u = \cos x$

$\frac{du}{dx} = -\sin x$

$du = -\sin x\,dx$

$-du = \sin x\,dx$

$y = -e^{\cos x} + c$

check y

$\frac{dy}{dx} = -e^{\cos x}\cdot(-\sin x)$

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$\int x^2\sqrt{5+2x^3}\,dx = \int \cancel{x^2}\sqrt{u}\,\frac{du}{6\cancel{x^2}}$

$u = 5+2x^3$

$\frac{du}{dx} = 6x^2$

$du = 6x^2\,dx$

$\frac{du}{6x^2} = dx$

$= \frac{1}{6}\int \sqrt{u}\,du = \frac{1}{6}\int u^{\frac{1}{2}}\,du$

$= \frac{1}{6}\cdot\frac{u^{3/2}}{3/2} + c$

$= \frac{1}{6}\,\frac{2}{3}\,u^{3/2} + c$

$y = \frac{1}{9}\left(5+2x^3\right)^{3/2} + c$

$y = \frac{\sqrt{(5+2x^3)^3}}{9} + c$

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$\int \cot(7x)\,dx = \int \frac{\cos(7x)}{\sin(7x)}\,dx$

let $u = \sin(7x)$

$\frac{du}{dx} = 7\cos(7x)$

$du = 7\cos(7x)\,dx$

$\frac{du}{7\cos(7x)} = dx$

$= \int \frac{\cancel{\cos(7x)}}{u}\,\frac{du}{7\cancel{\cos(7x)}}$

$= \frac{1}{7}\int \frac{1}{u}\,du$

$= \frac{1}{7}\ln|u| + c$

$= \frac{1}{7}\ln|\sin(7x)| + c$

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$$\int \frac{dx}{\cos^2 2x}$$

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$$\int \cot^2 3x\, dx$$

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$$\int \cos^3 x\, dx = \int \cos x \cdot \cos^2 x\, dx$$

$\sin^2 x + \cos^2 x = 1$

$\cos^2 x = 1 - \sin^2 x$

$$= \int \cancel{\cos x} \cdot (1 - \sin^2 x)\, \cancel{dx}$$

$u = \sin x$ $\qquad = \int 1 - u^2\, du$

$\frac{du}{dx} = \cos x$ $\qquad = u - \frac{u^3}{3} + c$

$du = \cos x\, dx$ $\qquad y = \sin x - \frac{\sin^3 x}{3} + c$

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Definite Integrals

$$\int_0^{\frac{\pi}{3}} \tan x \sec^2 (x)\, dx = \int_0^{\sqrt{3}} u\, du = \left. \frac{u^2}{2} \right|_0^{\sqrt{3}}$$

$u = \tan x$

$\frac{du}{dx} = \sec^2 x$ $\qquad = \frac{(\sqrt{3})^2}{2} - \frac{0^2}{2}$

$du = \sec^2 x\, dx$ $\qquad = \frac{3}{2}$

$x = 0 \quad u = \tan 0 = 0$

$x = \frac{\pi}{3} \quad u = \tan \frac{\pi}{3} = \sqrt{3}$

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$$\int_0^1 \frac{x}{x^2 - 4}\,dx$$

Nov 30-7:00 PM